Brief Report

Health knowledge among the millennial generation

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Significance for public health

Understanding how health knowledge is acquired by young people is a necessary first step to the creation of all health care programs. This study is a small step towards this understanding.

Abstract

The Millennial Generation, also known as Generation Y, is the demographic cohort following Generation X, and is generally regarded to be composed of those individuals born between 1980 and 2000. They are the first to grow up in an environment where health-related information is widely available by internet, TV and other electronic media, yet we know very little about the scope of their health knowledge. This study was undertaken to quantify two domains of clinically relevant health knowledge: factual content and ability to solve health related questions (application) in nine clinically related medical areas. Study subjects correctly answered, on average, 75% of health application questions but only 54% of health content questions. Since students were better able to correctly answer questions dealing with applications compared to those on factual content contemporary US high school students may not use traditional hierarchical learning models in acquisition of their health knowledge.

Introduction

Human disease is often complex, as are treatments. Thus, effective communication between healthcare providers and patients is ever more important in our efforts to improve healthcare as is a basic level of health knowledge by patients and it is founded upon adequate health knowledge and health literacy. We are aware that a large percentage of Americans have low health literacy skills,[1-6] which restricts their acquisition of health knowledge yet we are less knowledgeable about where young adult Americans acquire their health knowledge and the extent of their actual depth of understanding. In the past most Americans received the majority of their health education in high school yet in the 21st century health knowledge can now be acquired from many non-school sources, and particularly from the internet and other media. As health topics are being presented with increasing frequency on TV and web programs, the population is inundated with health-related information such as advertisements for drugs to treat diseases, to lose weight and to have greater energy. Although we know that many adult Americans use the Internet to search for health information including the Millennials,[7-13] it is unclear what the impact of this mix of sources of health-related information has been on health knowledge acquisition among young adults and how it will impact their health care in the future.

Numerous assessments of adolescents' health behaviors have been made,[9,14-16] and mass media has been shown to be an effective tool to change health behavior in adolescents.[16] However, quantitative studies to assess clinically relevant health knowledge among young adults have not been reported. Prior to the explosion of media-based health information, health education classes in middle and high school were the primary sources of health information to the public. The *curricula* in the US has been based upon theory that learning is hierarchical and that acquisition of content is a necessary base structure upon which comprehension, application and synthesis are sequentially built.[17,18] Some assessments of the use of the internet for health information have been performed yet this does not inform us as to the level of working health knowledge by the users.[19]

The present study was undertaken in an effort to learn the level of clinically related health knowledge possessed by 18 year old American high school students. In this context clinically relevant refers to knowledge that can be directly linked to physical health. Thus our goal is distinct from assessments of school health programs in the US over the past two decades which have placed increasing emphasis on promotion of healthy behaviors. As the instruments for assessment of these programs are not appropriate for our study we developed a health knowledge survey appropriate for high school seniors because high school is the last period of formal health education for most Americans. The survey we developed focuses on two domains of clinically relevant health knowledge, namely *health content*, which encompasses factual information, and *health application*, namely the ability to use health information in real-world situations.

Design and Methods

Study subjects

All high school seniors enrolled in five Central Pennsylvania public schools were invited to participate. The catchment areas for the schools included urban, suburban, and rural areas. Participation was voluntary, and students were provided with written information about the study to share with parents or guardians before participating. No identifying personal information was obtained. The study was approved by the Institutional Review Board of the Penn State Hershey Medical Center and by appropriate officials at each of the participating high schools.

Questionnaire

Although there are many health assessment questionnaires and surveys of use of online health information there are few validated instruments to evaluate health information.[15] Because no contemporary survey instruments were available for the assessment of health knowledge of clinically related questions appropriate for high school seniors, we constructed and tested a new survey instrument. The anonymous, multiple choice, questionnaire was designed to take not more than 25 minutes to complete and to be taken during school hours under supervision. The questionnaire was designed by a team of senior primary care physicians, epidemiologists, and health educators at Penn State to obtain information on study subject demographics, health content knowledge and health application knowledge in nine clinically relevant areas: nutrition, cancer, obesity, diabetes, risk-taking behaviors, physical activity, sexuality, cardiovascular health, and HIV/AIDS. Selection of the final questions was based on the criteria that each question was clinically relevant and would be on a subject and at a level that a clinician would expect a reasonably informed patient to be able to answer. There were correct, unambiguous answers for each question. For each of the nine topic areas we had at least one question in each of the two domains. All questions were multiple-choice, other than those for age, height, and weight. A second team of primary care physicians established the degree of difficulty for the survey by selecting questions which they believed could be correctly answered by 75% of public high school seniors. Prototypes of the questionnaire were piloted with three healthcare groups to identify and revise problematic questions. The three groups were: 12 physicians in a graduate course on Clinical Research Methods, the 60 person staff of the Department of Public Health Sciences, and 45 second-year medical students taking the Elements of Clinical Research course at Penn State College of Medicine. Overall, the three groups who pilot tested the questionnaire (Appendix) answered correctly 80-85% of both the content and application questions. Questionnaires were distributed in regular high school classes by a health or home room teacher, completed by the students, and collected by the teacher. Questionnaires were collected by study staff at each school and returned to Penn State University for scanning and data management.

Statistical methods

Demographic characteristics were summarized by percentages. The average content and application scores were compared between different demographic groups using analysis of variance. Nonparametric analyses of variance also were conducted to test the sensitivity of the results to the assumption of normality. The nonparametric analyses are not shown, as the results were consistent with the original analysis of variance models. An extension of logistic regression, generalized estimating equations with a logic link, was used to compute the predicted probability of answering questions correctly, while accounting for the multiple questions answered by each student. The distributions of the percentages of content and application questions answered correctly were compared by adding an indicator variable to this analysis to identify if a response was to a content or application question. A P-value of less than 0.05 was considered significant for all hypothesis testing. SAS version 9 (SAS Institute, Inc., Cary, NC) was used to perform all analyses.

Results

Of the 839 students enrolled at the five participating high schools, 802 completed questionnaires (95.6%). 13 questionnaires were unusable due to having more than one missing answer or to having been defaced leaving 789 usable questionnaires. The demographic characteristics of the study population are presented in Table 1. The study subjects were evenly divided by gender, were predominantly White, and two-thirds lived with both parents. This cohort reported that 46% of their health knowledge came from school

Table 1. Demographics of the high school senior study population.

Variables	%
Gender	
Male	50
Female	50
Ethnicity	
African American	3
Caucasian	85
Asian American	3
Indian native	1
Hawaiian other	17
Living with	
Both parents	67
Mother	22
Father	6
Other	5
Mother's highest level of education	
Some High School	6
High School graduate	35
Some College	17
College graduate	28
Graduate degree	14
Father's highest level of education	
Some High School	8
High School graduate	37
Some College	12
College graduate	26
Graduate degree	17
Family's total annual income	
<$25,000	3
$25,000 to $50,000	11
$50,000 to $100,000	27
>$100,000	17
Don't know	42
Student's exercise habits	
Little or none	17
1-2 times per week	21
3 or more times per week	33
Play on a high school or recreational athletic team	29
Student's smoking habit	
Never	78
Occasionally	12
Every day	10
Student's body type	
About average	33
Slender	19
Athletic	40
Full-figured	8
Mother's exercise habits	
None - occasionally	39
1-2 times per week	29
3 or more times per week	21
Don't know	11
Father's exercise habits	
None - occasionally	32
1-2 times per week	25
3 or more times per week	28
Don't know	
Mother's body type	
About average	52
Slender	19
Athletic	5
Full-figured	24
Father's body type	
About average	47
Slender	11
Athletic	20
Full-figured	22
Student's largest source of health information	
School	46
Media	20
Parents	29
Friends	5

sources, 29% from parents, 20% from media, and 4% from friends.

Overall, the study population answered 54% of the health knowledge content questions correctly and 75% of the health knowledge application questions correctly with no significant differences between schools. As shown by Figure 1, the data for correct responses are similarly distributed with the two curves being displaced one from another by about 20 percentage points. The distributions are skewed left so the means, reported above, are slightly lower than the medians (58% and 77% for content and application, respectively).

Table 2 displays the health content and health application scores as percentages as well as the relationships between the subjects' demographics and their health knowledge scores in the two domains of content and application. We observed that females had higher scores than males, and significant differences in scores were associated with ethnicity, the level of education attained by the respondents' parents, family income, parents' exercise habits, subject's body type and the subjects' smoking habits. In contrast, neither the students' exercise habits, nor their living arrangements, nor their reported sources of health information were significantly associated with differences in health content or health application scores. Regarding specific health areas, questions most likely to be answered correctly were in the areas of HIV/AIDS, risky behaviors, sexuality, and obesity and areas least likely to be answered correctly were cancer and nutrition (*data not shown*).

Discussion

Assessing clinically relevant health knowledge of young Americans is a logical initial step as we attempt to improve American health literacy and improve the ability of physicians and patients to understand one another in clinical settings. The education and healthcare communities are deeply engaged in trying to understand not only what but also how students in the Millennial generation learn.[9,10,14,20-25] The fact that 18 year old high school seniors are better able to answer health application questions than health content questions emphasizes our need to understand how young Americans are acquiring their health knowledge. Their access to information is unprecedented and it may be useful to consider a model for their knowledge accumulation as multiple domains with overlapping intersections as shown in Figure 2. The study subjects, most of whom were 18 years of age, are in the middle of the Millennial Generation, namely those born between 1980 and 2000. Studies to date on the attitudes and behaviors of the Millennials portray them as being optimistic, team-oriented achievers who embrace user-generated and user-controlled technology and are comfortable navigating complex multimodal digital environments.[22,26,27] Many US school districts continue to provide most of their health education in a single semester class in the 10th or 11th grade. However, high school students in contemporary America live among sound bites and fleeting images where much health related information is presented to them as health

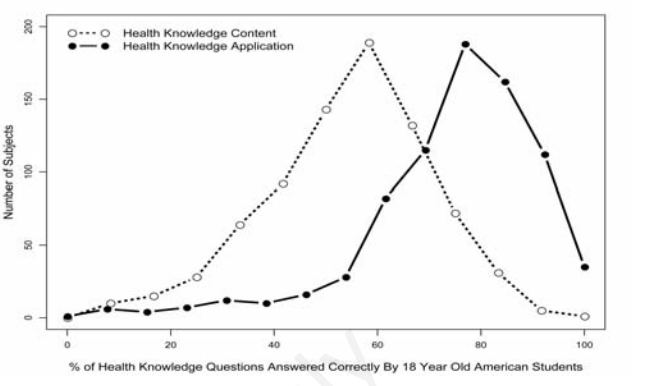

Figure 1. Data analysis: numbers of subjects/percentage of health knowledge questions answered correctly by 18 year-old American students.

Figure 2. Knowledge relationship for Millennial students.

Table 2. Relationships between the subjects' demographics and health knowledge content and health knowledge application scores.

Variables	Content		P-value	Application		P-value
	Mean	SD		Mean	SD	
Gender						
Males	52	17	0.0002	71	19	≤0.0001
Females	57	15		78	14	
Ethnicity						
Black	45	15		63	21	
White	55	16	0.001	76	16	0.001
Asian	54	19		74	17	
Other	50	16		72	18	
Smoking						
Never	55	15		76	15	
Occasionally	51	17	0.009	72	20	≤0.0001
Daily	51	18		69	22	
Subject's body type						
About average	-	-	-	77	15	
Slender	-	-	-	76	17	0.03
Athletic	-	-	-	73	17	
Full-figured	-	-	-	73	19	

SD, standard deviation.

advice bullets, such as, *don't smoke, do exercise, practice safe sex, wear sunscreen, and don't drink the tap water in Mexico*. The result is that they often do not know or understand the content from which the advice was derived. This type of advice-driven knowledge is likely to restrict and limit problem solving when faced with new or complex situations involving behavioral choices that impact health. For example, they may know not to drink the water in Mexico, but not realize that the ice in their soft drink in Mexico may be just as dangerous as the tap water. Although the Internet is being widely used to deliver health behavior change interventions aimed at adolescents and young adults, generalizable effective strategies are in their infancy.[4,7,10,13,16] Due to the increasingly complex medical therapies that are in place today a minimum level of *understanding* is necessary to grasp what healthcare providers are asking their patients to do. The present study has limitations. First, our results apply to 18 year old high school seniors living in the United States, and specifically, in Central Pennsylvania. There were many areas of interest in addition to the nine we used and several other knowledge domains, in addition to those of content and application, as used in this study. However, we were constrained by time limitations at the participating high schools which required that the questionnaire not take more than 25 minutes to complete. We constructed the two domains of questions with a similar range of difficulty. The fact that we did not observe any differences in the scores between the two domains of questions when the survey was piloted among two groups of healthcare professionals and one group of medical students indicates that there was a similar level of difficulty for the two domains of questions. The subjects in this study reported that their schools were their largest source of health information, followed by media and parents. The fact that the questionnaire was completed at school and during school hours may have influenced their choice. Additional studies of Millennials in other countries are needed to understand their most important sources of health information. The major finding of this study, namely, that high school seniors have higher levels of applied health knowledge compared to health content knowledge challenges the idea that a hierarchical learning model applies today in the acquisition of clinically relevant health knowledge. One of the logical next steps is to determine not only how Millennials acquire health knowledge but also if this knowledge becomes static or remains dynamic. Given what we now know about both the increasing amount of health information available to Millennials and their different patterns of knowledge acquisition, it is timely that the stakeholders in health education adapt teaching methods to confront the reality that the Millennial Generation and their successors will soon obtain the majority of their health information using new learning patterns and from ever evolving sources.

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